

Response
Application No. 10/501,080
Attorney Docket No. 042440

REMARKS

Rejections under 35 USC §103(a)

Claims 1, 3 and 4 are rejected under 35 USC §103(a) as being obvious over Shirakawa et al. (European Patent Application No. 0502471).

Applicant respectfully traverses this rejection.

Claim 1 recites “thermally annealing said impurity-doped silicon by a single heating, the single heating being in a temperature range from 250°C to 500°C to form a transition metal-O-C complex comprising an atom of said transition metal impurity, said C and said O, so as to precipitate said impurity complex at an interstitial position in said silicon crystal, whereby said transition metal impurity is confined in said silicon crystal to prevent the ultra high-speed diffusion of said transition metal impurity and electrically deactivate deep impurity levels to be induced by said transition metal impurity.”

Shirakawa et al discloses an intrinsic gettering heat treatment of silicon crystal.

Shirakawa et al describes as follows:

Thus, the present invention provides a process for the production of a semiconductor device, comprising a step of performing a heat treatment at a temperature of from 950°C to 1250°C for a period of from one to four hours on a silicon crystal having an impurity carbon concentration exceeding 1.0 ppm and not exceeding the solid solution limit thereby forming a denuded zone therein, a step of performing a heat treatment at a temperature of from 350 C to 600°C for a period of from one to 24 hours on the silicon crystal having the denuded zone formed therein thereby forming a complex defect of impurity oxygen and impurity carbon therein, and a step of performing a heat treatment on the silicon crystal having the complex defect formed therein by

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the elevation of the temperature of the silicon crystal at a temperature increasing rate such that no nucleous is broken, preferably from 0.2 to 3.0 °C /min. to a level of from 900°C to 1250°C, to thereby effect intrinsic gettering. This process is more effectively implemented when the set of the step of performing a heat treatment at a temperature of from 350°C to 600°C for a period of from one to 24 hours on the silicon crystal and the step of performing a heat treatment on the silicon crystal by the elevation of the temperature of the silicon crystal at a temperature increasing rate such that no nucleous is broken, preferably from 0.2 to 3.0°C/min. to a level of from 900°C to 1250°C is repeated a plurality of times.

(Page 4, lines 2-16).

The process of Shirakawa et al requires three heating steps: (1) a heat treatment at a temperature of from 950°C to 1250°C, (2) a heat treatment at a temperature of from 350 C to 600°C, and (3) a heat treatment by the elevation of the temperature of the silicon crystal at a temperature increasing rate such that no nucleous is broken to a level of from 900°C to 1250°C.

In contrast, according to the present invention, thermal annealing of the impurity-doped silicon is by a single heating in a temperature range from 250°C to 500°C.

Thus, Shirakawa et al does not teach or suggest “thermally annealing said impurity-doped silicon by a single heating, the single heating being in a temperature range from 250°C to 500°C to form a transition metal-O-C complex comprising an atom of said transition metal impurity, said C and said O, so as to precipitate said impurity complex at an interstitial position in said silicon crystal, whereby said transition metal impurity is confined in said silicon crystal to prevent the ultra high-speed diffusion of said transition metal impurity and electrically deactivate deep impurity levels to be induced by said transition metal impurity.”

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For at least these reasons, claim 1 should patentably distinguish over Shirakawa et al. Claims 3 and 4, depending from claim 1, also patentably distinguish over Shirakawa et al for at least the same reasons.

Thus, the 35 USC §103(a) rejection should be withdrawn.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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